Remarks

The Office Action mailed February 25, 2008 has been carefully reviewed and the following remarks have been made in consequence thereof.

Claims 1, 2, 4-6, 8-10, 12-15, 17, 19, 20, and 22-24 are now pending in this application. Claims 1, 2, 4-6, 8-10, 12-15, 17, 19, 20, and 22-24 stand rejected. Claims 3, 7, 11, 16, 18, 21, and 25 have been canceled.

The rejection of Claims 1, 2, 4-6, 8-10, 12-15, 17, 19, 20, and 22-24 under 35 U.S.C. § 103(a) as being unpatentable over Dam (U.S. Pat. No. 4,192,318) (hereinafter referred to as "Dam") in view of Cole, Jr. (U.S. Pat. No. 4,887,609) (hereinafter referred to as "Cole, Jr.") is respectfully traversed.

Dam describes an adaptive QRS detector for identifying an RS portion of a cardiac wave. The QRS detector includes a positive peak detector (23), a negative peak detector (25), a time delay network (19), a feedback control network (21) and a comparator (27). An input signal (99) is applied to the peak detectors (23 and 25), the time delay network (19), and the feedback control network (21). The peak detectors (23 and 25) each generate a respective detector output (104 or 106), the time delay network (19) generates a time delayed input signal (101), and the feedback control network (21) generates a modified signal (103). One of the detector outputs (104 or 106) is used as a feedback signal (105) that is applied to the feedback control network (21), and the modified signal is the input signal (99) combined with the feedback signal (105).

The time delayed input signal (101) and the modified signal (103) are applied to the comparator (27) such that the positive and negative peaks are used to determine the RS portion of the wave. More specifically, when the time delayed input signal (101) and the modified signal (103) are equal at a first time (T1) indicative of the R wave portion, the polarity of the comparator (27) switches from using the positive peak detector output (104) to using the negative peak detector output (106). When the time delayed input signal (101) and the modified signal (103) are equal again at a second time (T2) indicative of the S wave portion, the polarity of the comparator (27) switches from using the negative peak detector output (106) to using the positive peak detector output (104). As such, the output (102) of the comparator (27) includes a single transition that indicates the RS wave portion of the cardiac

wave form. The output (102) of the comparator (27) is used to trigger a conventional pulse shaping network. Notably, Dam does not describe or suggest generating a phase-delayed ECG of a heart at a second phase based on a time-delayed first ECG. Further, Dam does not describe or suggest determining if a first phase is within a predetermined time of a second phase.

Cole, Jr. describes supplying a filtered ECG signal to MRI equipment (7). The filtered signal can be used to synchronize activation and deactivation of the MRI equipment (7) with the variations of filtering characteristics of a variable filter (2) that is used to generate the filtered signal. The filtering characteristics of the variable filter (2) filter an ECG signal based on whether the MRI equipment (7) is collecting data. More specifically, when the MRI equipment (7) is collecting data, the variable filter (2) acts as a 50 Hz low pass filter and, when the MRI equipment (7) is not collecting data, the variable filter (2) acts as a 5 Hz low pass filter. As such, the filtering characteristics are determined based on the operation of the MRI equipment (7), and the filtered signal is used to control the MRI equipment (7). Notably, Cole, Jr. does not describe or suggest generating a phase-delayed ECG of a heart at a second phase based on a time-delayed first ECG. Further, Cole Jr. does not describe or suggest determining if a first phase is within a predetermined time of a second phase.

Claim 1 recites a method for generating an image of a heart at a selected cardiac phase, said method comprising "acquiring a first electrocardiogram (ECG) of the heart at a first phase . . . introducing a time delay into the first ECG . . . generating a phase-delayed ECG of the heart at a second phase based on the time-delayed first ECG . . . determining if the first phase is within a predetermined time of the second phase . . . and generating an image of the heart if the first phase is within the predetermined time of the second phase."

Neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method for generating an image of a heart at a selected cardiac phase as recited in Claim 1. More specifically, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes generating a phase-delayed ECG of a heart at a second phase based on a time-delayed first ECG. Further, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes determining if a first phase is within a predetermined time of a second phase. Rather, Dam describes identifying an RS portion of a cardiac wave using a feedback signal and a time delayed input signal, and Cole

Jr. describes using a filtered ECG signal to activate or deactivate MRI equipment according to filtering characteristics of a variable signal filter.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Dam in view of Cole Jr.

Claims 2 and 4-6 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 2 and 4-6 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2 and 4-6 likewise are patentable over Dam in view of Cole Jr.

Claim 8 recites a method for generating an image of a heart at a selected cardiac phase using an MRI imaging system, said method comprising "acquiring a first electrocardiogram (ECG) of the heart at a first phase . . . introducing a time delay into the first ECG . . . generating a second electrocardiogram (ECG) of the heart at a second phase based on the time-delayed first ECG . . . determining if the first phase is within a predetermined time of the second phase . . . and generating an MRI image of the heart if the first phase is within the predetermined time of the second phase."

Neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method for generating an image of a heart at a selected cardiac phase using an MRI imaging system as recited in Claim 8. More specifically, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes generating a second electrocardiogram (ECG) of a heart at a second phase based on a time-delayed first ECG. Further, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes determining if a first phase is within a predetermined time of a second phase. Rather, Dam describes identifying an RS portion of a cardiac wave using a feedback signal and a time delayed input signal, and Cole Jr. describes using a filtered ECG signal to activate or deactivate MRI equipment according to filtering characteristics of a variable signal filter.

Accordingly, for at least the reasons set forth above, Claim 8 is submitted to be patentable over Dam in view of Cole Jr.

Claims 9 and 10 depend, directly or indirectly, from independent Claim 8. When the recitations of Claims 9 and 10 are considered in combination with the recitations of Claim 8,

Applicants submit that dependent Claims 9 and 10 likewise are patentable over Dam in view of Cole Jr.

Claim 12 recites a method for generating an image of a heart at a selected cardiac phase, said method comprising "acquiring a first electrocardiogram (ECG) of the heart at a first phase . . . introducing a time delay into the first ECG . . . generating a second electrocardiogram (ECG) of the heart at a second phase based on the time-delayed first ECG . . . acquiring a first plethysmograph signal of the heart at a first phase . . . determining if the first phase is within a predetermined time of the second phase . . . and generating an MRI image of the heart if the first phase is within the predetermined time of the second phase."

Neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method for generating an image of a heart at a selected cardiac phase as recited in Claim 12. More specifically, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes generating a second electrocardiogram (ECG) of a heart at a second phase based on a time-delayed first ECG. Further, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a method that includes determining if a first phase is within a predetermined time of a second phase. Rather, Dam describes identifying an RS portion of a cardiac wave using a feedback signal and a time delayed input signal, and Cole Jr. describes using a filtered ECG signal to activate or deactivate MRI equipment according to filtering characteristics of a variable signal filter.

Accordingly, for at least the reasons set forth above, Claim 12 is submitted to be patentable over Dam in view of Cole Jr.

Claims 13-15 depend, directly or indirectly, from independent Claim 12. When the recitations of Claims 13-15 are considered in combination with the recitations of Claim 12, Applicants submit that dependent Claims 13-15 likewise are patentable over Dam in view of Cole Jr.

Claim 17 recites a magnetic resonance imaging (MRI) system comprising "a radio frequency (RF) coil assembly for imaging a subject volume . . . and a computer coupled to said RF coil, said computer configured to . . . acquire a first electrocardiogram (ECG) of the heart at a first phase . . . introduce a time delay into the first ECG . . . generate a phase-delayed ECG of the heart at a second phase based on the time-delayed first ECG . . .

determine if the first phase is within a predetermined time of the second phase . . . and generate an image of the heart if the first phase is within the predetermined time of the second phase."

Neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a magnetic resonance imaging (MRI) system as recited in Claim 17. More specifically, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a system that includes a computer configured to generate a phase-delayed ECG of a heart at a second phase based on a time-delayed first ECG. Further, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a system that includes a computer configured to determine if a first phase is within a predetermined time of a second phase. Rather, Dam describes identifying an RS portion of a cardiac wave using a feedback signal and a time delayed input signal, and Cole Jr. describes using a filtered ECG signal to activate or deactivate MRI equipment according to filtering characteristics of a variable signal filter.

Accordingly, for at least the reasons set forth above, Claim 17 is submitted to be patentable over Dam in view of Cole Jr.

Claims 19 and 20 depend directly from independent Claim 17. When the recitations of Claims 19 and 20 are considered in combination with the recitations of Claim 17, Applicants submit that dependent Claims 19 and 20 likewise are patentable over Dam in view of Cole Jr.

Claim 22 recites a computer program embodied on a computer readable medium for controlling a medical imaging system, said program configured to "acquire a first electrocardiogram (ECG) of the heart at a first phase . . . introduce a time delay into the first ECG . . . generate a second electrocardiogram (ECG) of the heart at a second phase based on the time-delayed first ECG . . . determine if the first phase is within a predetermined time of the second phase . . . and generate an MRI image of the heart if the first phase is within the predetermined time of the second phase."

Neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a computer program embodied on a computer readable medium for controlling a medical imaging system as recited in Claim 22. More specifically, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a computer program configured to

generate a second electrocardiogram (ECG) of a heart at a second phase based on a time-delayed first ECG. Further, neither Dam nor Cole Jr., considered alone or in combination, describes or suggests a computer program configured to determine if a first phase is within a predetermined time of a second phase. Rather, Dam describes identifying an RS portion of a cardiac wave using a feedback signal and a time delayed input signal, and Cole Jr. describes using a filtered ECG signal to activate or deactivate MRI equipment according to filtering characteristics of a variable signal filter.

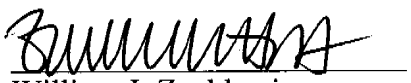
Accordingly, for at least the reasons set forth above, Claim 22 is submitted to be patentable over Dam in view of Cole Jr.

Claims 23 and 24 depend directly from independent Claim 22. When the recitations of Claims 23 and 24 are considered in combination with the recitations of Claim 22, Applicants submit that dependent Claims 23 and 24 likewise are patentable over Dam in view of Cole Jr.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 2, 4-6, 8-10, 12-15, 17, 19, 20, and 22-24 be withdrawn.

In view of the foregoing remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,



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